The proposal contained in this notice may be changed in the light of comments received.

An official docket will be available for examination by interested persons at the Federal Aviation Administration, Office of the General Counsel, Attention: Rules Docket, 800 Independence Avenue SW., Washington, DC 20591. An informal docket will also be available for examination at the office of the Regional Air Traffic Division Chief.

The FAA proposes to amend Part 75 of the Federal Aviation Regulations by designating an area high route as follows:

J990R Phoenix, Ariz., to Bridgeport, Tex.

Reference facility, Theta/Rho, north latitude/west longitude

Phoenix, Ariz., 111°53'17".	000.0/00.0,	33°25'53"/
St. Johns, Ariz., 109°11'49".	168.4/63.5,	33°21'55"/
Socorro, N. Mex., 107°16'48".	187.1/67.3,	33°16'57"/
Roswell, N. Mex., 104°37'15".	000.0/00.0,	33°20'15"/
Texico, N. Mex., 102°50'29".	169.1/68.7,	33°20'52"/
Abilene, Tex., 99°50'01".	351.7/49.5,	33°18'28"/
Ardmore, Okla., 97°45'58".	198.3/65.6,	33°14'16"/

This amendment is proposed under the authority of section 307(a) of the Federal Aviation Act of 1958 (48 U.S.C. 1348(a)) and section 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c)).

Issued in Washington, D.C., on November 30, 1971.

H. B. Helstrom,
*Chief, Airspace and Air
Traffic Rules Division.*

[FR Doc.71-17797 Filed 12-6-71;8:46 am]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 61]

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Proposed Standards for Asbestos, Beryllium, Mercury

Pursuant to section 112 of the Clean Air Act, as amended, the Administrator published in the Federal Register of March 31, 1971 [36 CFR Part 62] an initial list of three hazardous air pollutants which in his judgment may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness. Publication of the list constituted an announcement of the Administrator's intention of establishing, under section 112, national emission standards for certain source categories known to emit these hazardous pollutants. These standards are based on information derived from many sources, including health effects levels, meteorology, technical analysis of control capability, and consideration of economic impact. The overriding considerations are health effects. Considera-

tion also has been given to the need to minimize the emission of hazardous pollutants that can accumulate in the environment.

In many cases, information on possible sources of the hazardous pollutants is not available in sufficient detail to determine the need for emission standards. Investigations are underway to fill these gaps in knowledge, and the results of these investigations may require modification of these standards and inclusion of additional source categories for these pollutants.

Beryllium, mercury, and asbestos are very different in the number and type of sources and control options available; therefore, each standard has been written in a different manner to optimize effectiveness and facilitate compliance.

Asbestos—The proposed standards for asbestos are designed to minimize emissions to the atmosphere. Because there is no suitable technique for sampling and analyzing asbestos in the ambient air or in emission gases, the standards are expressed as requirements for the operation of specific control equipment (or other equipment of comparable effectiveness), or in situations where no control system is available as prohibitions on the use of asbestos. When acceptable source sampling and analytical methods are available and it is possible to delineate hazardous levels, these standards may be revised to require compliance with a measured allowable emission.

The sources covered in the asbestos standard are: Mining, milling, spraying, and manufacturing. Specific examples of emission sources which would be subject to the proposed standards applicable to manufacturers of asbestos-containing products include, but are not limited to, manufacturers of the following products when those products contain asbestos: Cement, textiles, paper and board, friction products, plastics, floor tiles, gaskets, packings, roofing felts, and insulation products.

Beryllium—A maximum allowable concentration of beryllium for ambient air has been in use by the Department of Defense and the Atomic Energy Commission for many years. This guideline has been used in the development of the beryllium standards. The proposed standards offer the owner or operator the option of measuring compliance by either emission testing or measurement of ambient concentration levels in the vicinity of the plant. However, it is anticipated that most sources will elect to comply with the given emission limitation. Buildings or other obstructions in the vicinity of the source, or location in highly urbanized areas, may make it impossible to design and locate a sampling network that provides sufficient assurance that areas of maximum concentration are measured.

The known major sources of beryllium are extraction plants, machine shops and foundries handling beryllium or beryllium-containing alloys, ceramic plants using beryllium, rocket propellants containing beryllium, and incinerators burning beryllium-containing waste. These are covered in the proposed standards.

Other possible sources of beryllium are being investigated, and those sources which can potentially cause ambient concentrations to exceed 0.01 $\mu g/m^3$ will be included in revisions to this standard.

Mercury—Information currently available suggests that an ambient concentration level in the air below one (1) microgram per cubic meter is sufficient to protect the public health from illness due to inhalation of mercury. However, mercury is mobile in the environment, and once released to the atmosphere may cycle between air, land, and water for long periods of time. Natural processes and living organisms can change mercury from one form to another, at times converting mercury into its most hazardous forms. Therefore, when sufficient information and understanding are available, it will be necessary to consider the broader environmental problems caused by mercury emissions to the atmosphere.

The only industries known to be emitting mercury in quantities and in a fashion such that these facilities, assuming a negligible background level, may cause the ambient concentration level to exceed 1 $\mu g/m^3$ are the facilities producing mercury from ore and the mercury cell chlor-alkali plants. These industries are covered in this standard. Other sources may emit mercury, but present information indicates that these sources alone will not cause the ambient concentration level to exceed 1 $\mu g/m^3$.

Investigations are underway to identify all mercury sources and to quantify their emissions into the air. As more information becomes available, this subpart will be revised, as necessary, to add additional source categories.

The proposed regulations require application to the Administrator for approval for construction or modification of any stationary source to which a standard prescribed in the regulations is applicable. The Administrator will notify the applicant of approval or disapproval of such application within 60 days of receipt. A fee will be charged to defray part or all the costs of the review. The fee structure will be revised from time to time as experience with the program is developed.

Omitted from the proposed regulations are provisions for delegations of authority to States under section 112(d) (1). Nevertheless, it is the Administrator's intention to encourage States to assume the principal responsibility for enforcement of national emission standards for hazardous air pollutants. Toward this end, procedures for delegating authority will be established early next year, after the States have submitted their plans for implementation of national ambient air quality standards.

In accordance with section 117(f) of the Act, publication of these proposed standards was preceded by consultation with appropriate advisory committees, independent experts, and Federal departments and agencies.

Interested persons may participate in this rule making by submitting written comments in triplicate to the Environmental Protection Agency, Office of Air

Programs, Division of Compliance, Research Triangle Park, N.C. 27711. The Administrator will welcome comments on all aspects of the proposed regulations, including economic and technological issues and on the proposed test methods. All relevant comments received not later than 90 days after the date of publication of this notice will be considered. Receipt of comments will be acknowledged, but the Office of Air Programs will not provide substantive responses to individual comments.

Public hearings will be held as required by section 112(b)(1)(B) of the Clean Air Act. A notice of time, date, and place for these public hearings will be published in the FEDERAL REGISTER within 30 days of the publication date of these standards. Not later than 180 days after publication of the emission standards set forth below, the Administrator is required to promulgate such emission standards, unless he finds, on the basis of information presented at public hearings, that the pollutants in question clearly are not hazardous. Accordingly, all persons having scientific information pertinent either to the question of whether asbestos, beryllium, and/or mercury are in fact, hazardous within the meaning of section 112 of the Clean Air Act or to the question of the level of the various substances that constitute a risk to public health are urged to present such information either by testifying at the hearings or by submitting the data for the hearings record. In addition, all interested persons are specifically asked to present information on the extent to which promulgation of these emission standards for asbestos, beryllium, and mercury will be of benefit to the public health. In any testimony or written comments on the specific points mentioned herein or on other matters relevant to this proposed rule making, all assertions and claims should be fully substantiated by factual information.

Summaries of the pertinent data used in developing these standards are available free of charge from the Environmental Protection Agency, Office of Air Programs, Research Triangle Park, N.C. 27711.

This notice of proposed rule making is issued under the authority of sections 112 and 114 of the Clean Air Act, Public Law 91–604, 84 Stat. 1713.

WILLIAM D. RUCKELSHAUS,
Administrator,
Environmental Protection Agency.

NOVEMBER 30, 1971.

PART 61—NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

Subpart A—General Provisions

§ 61.01 Applicability.

The provisions of this part apply to the owner or operator of any source which is operated, or the construction or modification of which is commenced after the date of publication in the FEDERAL REGISTER of proposed emission standards for hazardous air pollutants which are applicable to such source.

§ 61.02 Definitions.

As used in this part, all terms not defined in these subparts shall have the meaning given them in the Act:

(a) "Act" means the Clean Air Act (42 U.S.C. 1857 et seq., as amended by Public Law 91–604, 84 Stat. 1676).

(b) "Administrator" means the Administrator of the Environmental Protection Agency or his authorized representative.

(c) "Commenced" means that an owner or operator and a contractor to, or affiliate of, such owner or operator have entered into a binding agreement or contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.

(d) "Construction" means fabrication, erection, or installation of a stationary source.

(e) "Emission test" means measurement and analysis of emissions or other procedures used for the purpose of determining compliance with a standard for hazardous air pollutants.

(f) "Existing source" means any stationary source which is not a "new source".

(g) "Modification" means any physical change in, or change in the method of operation of, a stationary source which increases the amount of any hazardous air pollutant emitted by such source or which results in the emission of any hazardous air pollutant not previously emitted, except that routine maintenance, repair, and replacement shall not be considered physical changes.

(h) "New source" means any stationary source, the construction or modification of which is commenced after the publication in the FEDERAL REGISTER of proposed national emission standards for hazardous air pollutants which will be applicable to such facility.

(i) "Owner or operator" means any person who owns, leases, operates, controls, or supervises a stationary source.

(j) "Start up of operation" means the beginning of routine operation of a stationary source.

(k) "Stationary source" means any building, structure, facility, or installation which emits or may emit any hazardous air pollutant.

§ 61.03 Abbreviations.

The abbreviations used in this part have the following meanings:

cfm—Cubic feet per minute.
ft²—Square feet.
ft³—Cubic feet.
°F—Degree Fahrenheit.
in.—Inch.
l—Liter.
mg—Milligram.
ml—Milliliter.
M—Molar.
nm—Nanometer.
v/v—Volume per volume.
w.g.—Water gauge.
W/V—Weight per volume.
μg/m³—Micrograms per cubic meter.
%—Percent.

§ 61.04 Address.

All applications, requests, submissions and inquiries under this part shall be addressed to the Environmental Protection Agency, Office of Air Programs, Division of Compliance, Research Triangle Park, N.C. 27711.

§ 61.05 Prohibited activities.

(a) After the effective date of any emission standard prescribed under this part, no person shall construct or modify any stationary source subject to such standards without first obtaining written approval of the Administrator in accordance with this subpart, except under an exemption granted by the President under section 112(c)(2) of the Act.

(b) Ninety days after the effective date of any emission standard prescribed by this part, no person shall operate any stationary source in violation of such standard except under a waiver granted by the Administrator in accordance with this subpart or under any exemption granted by the President under section 112(c)(2) of the Act.

§ 61.06 Determination of construction or modification.

Upon written application therefor by an owner or operator, the Administrator will make a determination of whether actions taken or intended to be taken by such owner or operator constitute construction or modification or the commencement thereof within the meaning of this part.

§ 61.07 Application for approval for construction or modification.

(a) The owner or operator of any stationary source to which a standard prescribed under this part will be or is applicable shall, not less than 60 days prior to the date on which construction or modification is planned to commence, submit to the Administrator an application for approval of such construction or modification.

(b) A separate application shall be submitted for each stationary source.

(c) Each application shall include the following:

(1) Name and address of the applicant.

(2) Location or proposed location of the source.

(3) Technical information describing the proposed nature, size, design, and method of operation of the source, including a description of any equipment to be used for measurement or control of emissions.

§ 61.08 Approval by Administrator.

(a) The Administrator will, within 60 days of receipt of application, notify the owner or operator of approval or disapproval of construction or modification.

(b) If the Administrator determines, based on information included in an application submitted under § 61.06 or other information that a stationary source for which an application pursuant to § 61.06 was submitted will, if properly operated not cause emissions in violation of an applicable standard, he will approve the construction or modification of such source.

(c) Prior to denying any request for approval of construction or modification pursuant to this section, the Administrator will notify the person making such request of the Administrator's intention to issue such, together with:

(1) Notice of the information and findings on which such intended denial is based, and

(2) Notice of opportunity for such person to present additional information or arguments, orally or in writing, to the Administrator prior to final action on such request.

(d) A final determination to deny any request for approval will be in writing and will set forth the specific grounds on which such denial is based.

(e) Neither the submission of an application for approval or the Administrator's granting of approval to construct or modify shall:

(1) Relieve an owner or operator of legal responsibility for compliance with any applicable provisions of this part or of any applicable State or local requirement, or

(2) Prevent the Administrator from implementing or enforcing this part or taking any other action under the Act.

§ 61.09 Source reporting.

(a) The owner or operator of any existing stationary source to which a standard prescribed in this part is applicable shall, within 30 days after the effective date of such standard, provide the Administrator the following information:

(1) Name and address of the owner or operator.

(2) Identification and location of the source.

(3) Brief description of the nature, size, design, and method of operation including description of any equipment used for the measurement or control of emissions.

(b) Changes in the information provided under paragraphs (a) (1) and (3) of this section shall be provided to the Administrator within 90 days of such change.

§ 61.10 Request for waiver of compliance.

(a) The owner or operator of an existing stationary source unable to operate in compliance with a standard or standards prescribed in this part may request a waiver of compliance with any applicable emission standard under this part for a period not exceeding 2 years.

(b) Any such request shall be in writing and shall include:

(1) The owner's or operator's name and address.

(2) Identification and location of the source.

(3) Technical information describing the nature, size, design, and method of operation of the source, including a description of any equipment used for measurement or control of emissions.

(4) Description of the controls necessary for compliance with the applicable standard and plans for installation of such controls.

(5) A time schedule for obtaining, producing, or installing such controls. The schedule should include interim measures to achieve compliance.

(6) Description of the emission control steps or other measures which will be taken by the owner during the waiver

period to assure that the health of persons will be protected from imminent endangerment.

(c) As used in this subpart, "imminent endangerment" means an immediate risk of significant harm to the human body.

§ 61.11 Waiver.

(a) Based on the information provided in any request under § 61.09 and any other information, the Administrator may grant a waiver of compliance with the applicable emission standard for a period not exceeding 2 years.

(b) Any such waiver shall be in writing and shall:

(1) Identify the source covered.

(2) Specify the termination date of the waiver.

(3) Impose such reasonable conditions as the Administrator determines to be necessary to assure installation of the necessary controls within the waiver period and to assure protection of the health of persons from imminent endangerment during the waiver period.

(c) Prior to finally denying any request for a waiver pursuant to this section, the Administrator will notify the person making such request of the Administrator's intention to issue such denial, together with:

(1) Notice of the information and findings on which such intended denial is based, and

(2) Notice of opportunity for such person to present additional information or arguments, orally or in writing, to the Administrator prior to final action on such request.

(d) A final determination to deny any request for a waiver will be in writing and will set forth the specific grounds on which such denial is based.

§ 61.12 Emission tests and monitoring.

(a) Emission tests and monitoring shall be conducted and results reported in accordance with the test methods and reporting requirements set forth in this part.

(b) At the request of the Administrator, the owner or operator of a source subject to this part shall provide, or cause to be provided, emission testing facilities as follows:

(1) Sampling ports adequate for test methods applicable to such source.

(2) Safe sampling platform(s).

(3) Safe access to sampling platform(s).

(4) Utilities for sampling and testing equipment.

§ 61.13 Availability of information.

(a) Emission data provided to, or otherwise obtained by, the Administrator in accordance with the provisions of this part shall be available to the public.

(b) Any records, reports, or information provided to, or otherwise obtained by, the Administrator in accordance with the provisions of this part shall be available to the public, except that upon a showing satisfactory to the Administrator by any person that such records, reports, or information, or particular part thereof (other than emission data), if made public, would divulge methods or processes

entitled to protection as trade secrets of such person, the Administrator shall consider such records, reports, or information, or particular part thereof, confidential in accordance with the purposes of section 1905 of title 18 of the United States Code, except that such records, reports, or information, or particular part thereof, may be disclosed to other officers, employees, or authorized representatives of the United States concerned with carrying out the provisions of the Act or when relevant in any proceeding under the Act.

§ 61.14 State authority.

The provisions of this part shall not be construed in any manner to preclude any State or political subdivision thereof from:

(a) Adopting and enforcing any emission standard or limitation applicable to a stationary source provided that such emission standard or limitation is not less stringent than the national emission standard for hazardous air pollutants applicable to such source.

(b) Requiring the owner or operator of a stationary source to obtain permits, licenses, or approvals prior to initiating construction, modification, or operation of such source.

Subpart B—National Emission Standards for Asbestos

§ 61.20 Applicability.

The provisions of this subpart are applicable to the following sources of atmospheric asbestos:

Asbestos mines;
Asbestos mills;
Buildings, structures, or facilities within which manufacturing or fabricating operations involving the use of commercial asbestos are carried on;
Buildings or structures which have been or will be constructed or modified using asbestos insulating products;
Roadway facilities which would be surfaced or resurfaced using asbestos tailings.

§ 61.21 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given in the Act and in Subpart A of this part.

(a) "Asbestos" means any of six naturally occurring, hydrated mineral silicates: Actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite.

(b) "Commercial asbestos" means any variety of asbestos which is produced by the concentration of asbestos ore.

(c) "Asbestos mine" means any facility engaged in the extraction of asbestos ore from the earth for the purpose of recovering commercial asbestos.

(d) "Air flow permeability" means the volumetric rate of air flow in cfm, produced by a pressure decrease of 0.5 in. w.g. across a new, clean filtering fabric, divided by the area of the fabric in ft². The test air stream is maintained at nominal atmospheric pressure and temperature.

(e) "Dry drilling" means the process of drilling holes in the earth in the absence of an applied liquid stream, mist-containing stream or air stream.

(f) "Air-swept drilling" means the process of drilling holes in the earth in the presence of a forced or induced air stream, but not a liquid stream or mist-containing stream.

(g) "Wet drilling" means the process of drilling holes in the earth in the presence of a forced liquid stream or mist-containing stream.

(h) "Particulate matter" means any material, other than uncombined water, which exists in a finely divided form as a liquid or solid.

(i) "Asbestos tailings" means any solid waste product of asbestos mining or milling operations which contains asbestos.

(j) "Visible emission" means, for the purpose of this subpart, any emission which is visually detectable.

(k) "Asbestos mill" means any facility engaged in the conversion of asbestos ore into commercial asbestos.

(l) "Manufacturing operation" means the processing of commercial asbestos or the production of any product containing commercial asbestos.

(m) "Fabricating" means the cutting, shaping, assembly, mixing or other altering of any manufactured product containing commercial asbestos.

§ 61.22 Emission standards for asbestos.

(a) Emissions to the atmosphere from asbestos mines shall be limited as follows:

(1) Emissions of particulate matter from air-swept or dry drilling operations shall not exceed those which would be emitted from an air-swept or dry drill, respectively, equipped with a fabric filter device for collection of dust generated from drilling, as described in § 61.23(a).

(2) Emissions of particulate matter from wet drilling operations shall not exceed those which would be emitted from a wet drill equipped with a cyclone gas cleaning device for collection of dust or mist generated from drilling as described in § 61.23(b).

(3) Visible emissions of particulate matter from any mine road surfaced with asbestos tailings are prohibited.

(b) Emissions to the atmosphere from asbestos mills shall be limited as follows:

(1) Visible emissions of particulate matter from asbestos ore dumps, open storage areas for asbestos-containing materials, external conveyors for asbestos-containing materials, or asbestos-containing tailings dumps are prohibited.

(2) Emissions of particulate matter from asbestos ore dryers shall not exceed those which would be emitted from asbestos ore dryers equipped with fabric filter installations as described in § 61.23 (c).

(3) Emissions of particulate matter from air streams used to process asbestos ores or for exhausting particulate matter resulting from milling operations shall not exceed the amounts which would be emitted if such air streams were treated in fabric filter installations as described in § 61.23(d).

(4) Emissions of particulate matter from any milling operation which continuously generates visible emissions shall not exceed the amounts which would be emitted if such air streams

were treated in fabric filter installations as described in § 61.23(d).

(c) Emissions to the atmosphere from buildings, structures, or facilities within which any fabricating or manufacturing operation is carried on shall be limited as follows:

(1) Emissions, in direct forced gas streams, of particulate matter resulting from manufacturing or fabricating operations shall not exceed the amounts which would be emitted if such forced exhausts were treated in fabric filter installations as described in § 61.23(d) or, where approved by the Administrator because of special process conditions, in wet collectors as described in § 61.23(f).

(2) Emissions of particulate matter from any manufacturing or fabricating operation which continuously generates visible emissions shall not exceed the amount which would be emitted if the air containing such emissions were treated in fabric filter installations as described in § 61.23(d) or, where approved by the Administrator because of special process conditions, in wet collectors as described in § 61.23(f).

(3) Visible emissions of particulate matter from any manufacturing or fabricating operations in an area directly open to the atmosphere are prohibited.

(d) Visible emissions to the atmosphere of asbestos particulate matter resulting from the repair or demolition of any building or structure, other than a single-family dwelling are prohibited.

(e) The spraying of asbestos is limited as follows:

(1) The spraying of any product which contains asbestos on any portion of a building or structure is prohibited.

(2) The spraying of any product which contains asbestos in an area directly open to the atmosphere is prohibited.

(3) Emissions of particulate matter from spraying of any product which contains asbestos, if such spraying is not specifically prohibited in subparagraphs (1) or (2) of this paragraph, shall not exceed the amounts which would be emitted if the air containing such emissions were treated in fabric filter installations as described in § 61.23(d) or, where approved by the Administrator because of special process conditions, in wet collectors as described in § 61.23(f).

(f) The surfacing or resurfacing of any roadway with asbestos tailings is prohibited.

§ 61.23 Referenced equipment specifications.

(a) Fabric filters referred to in § 61.22(a)(1) are equipped with fabrics having airflow permeabilities not exceeding 40 cfm/ft².

(b) Cyclone collectors referred to in § 61.22(a)(2) are operated at not less than 7 in. w.g. pressure decrease as measured from the cyclone inlet to the outlet.

(c) Fabric filters referred to in § 61.22(b)(2) are equipped with fabrics having airflow permeabilities not exceeding 30 cfm/ft².

(d) Fabric filters referred to in § 61.22(b)(3) and (4), (c)(1) and (2), and (e)(3) are equipped with woven cotton fabrics having airflow permeabilities not

exceeding 20 cfm/ft². No bypass devices are utilized, and provisions are made for emptying the collection hoppers without creating visible emissions of particulate matter.

(e) Fabric filter devices do not meet the descriptions in paragraphs (a), (c), and (d) of this section if any of the following conditions exist:

(1) Leakage of gases, containing particulate matter, from the control system prior to filtration.

(2) Torn or ruptured bags.

(3) Improperly positioned bags.

(4) Badly worn or threadbare bags.

(f) Wet collectors referred to in § 61.22(c) (1) and (2) and (e) (3) are of the high-energy venturi type operated with a minimum gas pressure decrease across the venturi throat of 40 inches w.g.

(g) Wet collectors do not meet the description in paragraph (f) of this section if any of the following conditions exist:

(1) Leakage of gases containing particulate matter from the control system prior to filtration.

(2) Operation at less than 40 inches w.g. pressure decrease.

(3) Operation at a scrubbing medium flow rate less than specified by the manufacturer for optimum collection efficiency.

§ 61.24 Substitute devices for the attainment of equivalent emission control.

(a) Compliance with any applicable standard of this subpart which refers to a control equipment specification in § 61.23 shall be demonstrated in accordance with this section if the referenced control equipment is not used.

(b) The owner or operator of the emission source shall make available to the Administrator sufficient information as may be required to demonstrate that the substitute equipment will provide the degree of control which, in the judgment of the Administrator, is at least as stringent as that which would be achieved by using the equipment specified in the applicable standard. To the maximum extent practicable, the determination of equivalent degree of emission control will be based upon operation at the actual conditions at which the substitute device is or will be operated on the emission source. Factors which will be considered include, but are not limited to, collection efficiency, reliability, and maintenance practices associated with proper operation of the substitute device.

(c) The owner or operator of the emission source shall submit to the Administrator performance data including, but not limited to, total mass collection efficiency of the substitute control device under actual operating conditions or conditions which are representative of those of the existing or planned operating conditions.

(d) In cases for which it is not reasonable, in the judgment of the Administrator, to require an owner or operator to submit performance data which are based upon actual operating conditions or conditions which are representative of

these, the owner or operator shall make available to the Administrator performance data on comparative tests, using suitable standard test aerosols, on the substitute device and the device specified by the applicable standard. The performance data shall include, but not be limited to, the total mass efficiencies of the substitute device and the device specified by the applicable standard.

(e) The total mass efficiency of any substitute device for those specified by § 61.23 (a), (c), or (d) shall not be less than 99.9 percent.

(f) The total mass efficiency of any substitute device for that specified by § 61.23(b) shall not be less than 85 percent.

(g) The total mass efficiency of any substitute device for that specified by § 61.23(f) shall not be less than 99.5 percent.

Subpart C—National Emission Standards for Beryllium

§ 61.30 Applicability.

The provisions of this subpart are applicable to the following sources:

Machine shops;
Ceramic plants;
Propellant plants;
Foundries;
Extraction plants;
Incinerators designed or modified for disposal of toxic substances.

§ 61.31 Definitions.

As use in this subpart, all terms not defined herein shall have the meaning given them by the Act and in Subpart A of this part.

(a) "Beryllium" means the element beryllium excluding any associated elements.

(b) "Extraction plant" means a facility chemically processing beryllium ore to beryllium metal, alloy or oxide, or performing any of the intermediate steps in these processes.

(c) "Beryllium ore" means any material mined, hand cobbed, or gathered in any way specifically for its beryllium content.

(d) "Machine shop" means a facility performing cutting, grinding, turning, honing, milling, deburring, lapping, electrochemical machining, hot rolling, etching or other similar operations on beryllium metal, alloys or oxide.

(e) "Ceramic plant" means a manufacturing plant producing commercial ceramic stock forms, ware, or other items from beryllium oxide.

(f) "Foundry" means a facility engaged in the melting and/or casting of beryllium metal or alloy.

(g) "Propellant" means a fuel and oxidizer physically or chemically combined which undergoes combustion to provide rocket propulsion.

(h) "Beryllium alloy" means any metal to which beryllium is deliberately added and contains more than 0.1 percent beryllium by weight.

(i) "Propellant plant" means any facility engaged in the mixing, casting, or machining of propellant that contains beryllium.

(j) "Total emissions" means the emissions of beryllium in any form or any compound, from all points within a stationary source including emissions from the disposal of beryllium contaminated waste.

§ 61.32 Emission standards for beryllium.

A stationary source subject to this subpart shall, in accordance with the provisions of § 61.38, elect to comply with either paragraph (a) or (b) of this section.

(a) Total emissions to the atmosphere from sources subject to this subpart shall not exceed 10 grams of beryllium in a 24-hour day as measured in accordance with Method 3 in the appendix.

(b) Total emissions to the atmosphere from sources subject to this subpart shall not exceed amounts which result in an outplant concentration of 0.01 micrograms of beryllium per cubic meter of air averaged over a 30-day period, measured in accordance with a sampling network approved by the Administrator.

§ 61.33 Test methods and procedures—stack sampling.

Owners or operators electing to comply with § 61.32(a) shall comply with the requirements of this section and § 61.34.

(a) All beryllium emissions shall be transported through stacks or ducts which permit testing by the methods set forth in Method 3 in the appendix to this part.

(b) All tests shall be conducted to indicate the weight emitted per 24-hour day.

(c) Method 3 set forth in the appendix to this part shall be used as follows:

(1) The minimum sampling time shall be 2 hours, and the minimum sampling volume shall be 75 ft³ as measured by the gas meter. The total gas volume sampled at stack conditions shall be calculated.

(2) The velocity of the effluents shall be determined at stack conditions.

(3) For each repitition, beryllium emission expressed in grams per day shall be determined in accordance with Method 3.

§ 61.34 Periodic stack sampling and reports.

(a) All existing sources shall be tested within 3 months of the effective date of these regulations and at least once every 3 months thereafter.

(b) All sources constructed after the effective date of these regulations shall be tested immediately upon start-up of operations and at least once every 3 months thereafter.

(c) Samples shall be taken over such a period or periods as are necessary to accurately determine the maximum emissions which would occur in a 24-hour period. In the case of cyclic operations, sufficient tests shall be made so as to allow accurate determination or calculation of the emissions which will occur over the duration of the cycle.

(d) All samples shall be analyzed, and beryllium emissions shall be calculated within 5 working days after collection of samples. A total emission exceeding the

standard shall be reported to the Administrator immediately following determination of such emission.

(e) A written test report shall be made as soon as the calculations are completed and shall be retained available for inspection by the Administrator for a period of at least 2 years after the date of such report.

(f) Test reports shall include, as a minimum, detailed information on testing and test calculations, records of operations, unusual occurrences that might affect emissions, and the calculations correlating operations with test results sufficient to show maximum 24-hour beryllium emissions.

§ 61.35 Waiver of periodic stack sampling and report requirements.

(a) After performance of initial emission tests, the requirements of § 61.34 may be waived upon written application to the Administrator if in his judgment the installed control systems and the operating procedures are deemed adequate to insure the standard will be met. This waiver in no way prohibits the Administrator from requiring one or more emission tests.

(b) Detailed information on necessary requirements for waiver qualification may be obtained by submitting a written request to the Environmental Protection Agency, Office of Air Programs, Division of Compliance, Research Triangle Park, N.C. 27711.

§ 61.36 Test methods and procedures—air sampling.

Sources electing to comply with § 61.32 (b) shall comply with the requirements of this section and § 61.37.

(a) Air sampling sites shall be located in such a manner as is calculated to detect maximum ambient air concentrations of beryllium near ground level.

(b) Ambient air concentrations of beryllium shall be determined in accordance with a method approved by the Administrator.

§ 61.37 Monitoring and reports—air sampling.

(a) Ambient air shall be continuously monitored at all monitoring sites except for a reasonable time allowance for instrument maintenance and calibration, for changing filters, or for replacement of equipment needing major repair.

(b) Filters shall be changed at least every 4 days and shall be analyzed within 24 hours after collection.

(c) A written test report shall be made and shall be retained, available for inspection by the Administrator, for a period of at least 2 years after the date of such report.

(d) Test reports shall include, as a minimum, detailed information on testing and test calculations, records of operations, and unusual occurrences that might affect emissions.

(e) A test result on any sample of more than 0.03 $\mu g/m^3$ or the determination of an average 30 day concentration exceeding 0.01 $\mu g/m^3$ shall immediately be reported to the Administrator.

§ 61.38 Election.

(a) Owners or operators electing to comply with the standard in § 61.32(b) shall so notify the Administrator within 30 days of the effective date of these standards. A report setting forth the information listed below shall be submitted to the Administrator for approval within 45 days of such effective date.

The information shall include:

(1) Description of sampling method.
(2) Method of sample analysis.
(3) Method and frequency of calibration.
(4) Averaging technique for determining 30-day average concentration.
(5) Identity and number of sampling sites. Whether the sites are existing or proposed shall be indicated.
(6) Sampling locations (address, coordinates, or distance and heading from plant).
(7) Ground elevation and height above ground of sampling inlet.
(8) Sampling location relative to obstructions.
(9) Meteorological and existing air sampling data used to determine relative distribution of ambient air concentrations surrounding the plant.
(10) Plant and sampling area plots showing emission points and sampling sites. Topographic features significantly affecting dispersion shall be indicated.
(11) Plant building heights.
(12) Stack parameters necessary for estimating dispersion (stack height, inside diameter, exit gas temperature, and exit velocity or flow rate).

If the election is not made, the report not submitted, or the Administrator disapproves any portion of the air sampling network, compliance with the standard will be determined under § 61.32(a).

(b) Prior to disapproving any report under paragraph (a) of this section, the Administrator will consult with representatives of the source for which the report is submitted.

(c) If the Administrator at any time has reason to believe an approved network may not be sampling at points of maximum concentration, he may request changes in, or expansion of, the sampling network.

Subpart D—National Emission Standards for Beryllium-Rocket Motor Firing

§ 61.40 Applicability.

The provisions of this subpart are applicable to rocket motor test sites.

§ 61.41 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them by the Act and in Subpart A of this part.

(a) "Rocket motor test site" means any building, structure, or installation where the static test firing of a rocket motor is conducted.

(b) "Beryllium propellant" means any solid propellant incorporating beryllium particles as a fuel.

§ 61.42 Beryllium emission standards.

(a) Emissions to the atmosphere from sources subject to this subpart shall not cause atmospheric concentrations of beryllium to exceed 75 microgram minutes per cubic meter of air within 10 to 60 minutes, accumulated during any 2 consecutive weeks, measured anywhere beyond the property line of such source or at the nearest place of human habitation.

(b) If combustion products of motors containing beryllium propellant are fired into a closed tank, emissions from such tank shall not exceed 2 grams per hour and a maximum of 10 grams per day.

§ 61.43 Test methods and procedures—air sampling.

(a) Compliance with the standard in § 61.42(a) shall be determined in accordance with this section and § 61.46.

(b) Air sampling instruments and sites shall be selected to accurately reflect the effect of rocket motor firing on ambient air concentrations of beryllium near ground level. Such numbers and sites shall be approved by the Administrator.

(c) Ambient air concentrations of beryllium shall be determined according to a method approved by the Administrator.

§ 61.44 Test methods and procedures—stack sampling.

(a) Compliance with the standard in § 61.42(b) shall be determined in accordance with this section and § 61.46.

(b) Test methods and procedures for stack sampling in § 61.33 shall apply, with the exclusion of requirements in § 61.34.

§ 61.45 Monitoring and reports for air sampling.

(a) Ambient air concentrations shall be measured during and after firing of rocket motors and in such a manner that the effect of these emissions can be compared with the standard. Such sampling techniques shall be approved by the Administrator.

(b) Samples shall be analyzed and results shall be calculated before any subsequent rocket motor firing.

(c) A written test report shall be made and shall be retained for inspection by the Administrator for a period of at least 2 years after the date of the report.

(d) Test reports shall include, as a minimum, detailed information on testing and test calculations, a record of the rocket firing, and unusual occurrences that might affect emissions.

(e) A test result exceeding the standard shall be reported to the Administrator on the next business day following determination of such test result.

§ 61.46 Stack sampling and reports.

(a) The provisions of this section are applicable to monitoring and reporting beryllium emissions for determining compliance with the standard of § 61.42(b).

(b) Each release of combustion products to the atmosphere shall be monitored in such a manner as to show the maximum total emission during a 24-hour period.

(c) Samples shall be analyzed, and results shall be calculated before any subsequent rocket motor is fired.

(d) A written test report shall be made and shall be retained for inspection by the Administrator for a period of at least 2 years after the date of such report.

(e) Test reports shall include, as a minimum, detailed information on testing and test calculations, a record of the rocket firing, and unusual occurrences that might affect emissions.

(f) A test result exceeding the standard will be reported to the Administrator immediately following determination of such test result.

Subpart E—National Emission Standard for Mercury

§ 61.50 Applicability.

The provisions of this subpart are applicable to facilities processing ore to recover mercury and facilities using mercury chlor-alkali cells to produce chlorine gas and alkali metal hydroxide.

§ 61.51 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in Subpart A of this part.

(a) "Total mercury" means the element mercury, excluding any associated elements, and includes mercury in particulates, vapors, aerosols, and compounds.

(b) "Mercury ore" means a mineral mined specifically for its mercury content.

(c) "Mercury ore processing facility" means a facility processing mercury ore to obtain mercury.

(d) "Mercury chlor-alkali cell" means any device utilizing mercury as a cathode in an electrolytic process to produce chlorine gas and alkali metal hydroxide.

(e) "Denuder" means a horizontal or vertical container which is part of a mercury chlor-alkali cell and in which water and alkali-metal amalgam is converted to alkali metal hydroxide, metallic mercury and hydrogen gas in a short-circuited, electrolytic reaction.

(f) "Hydrogen gas stream" means a hydrogen stream formed in the chlor-alkali cell denuder.

(g) "End box" means a container located on each end of a chlor-alkali cell which functions as a collection point for mercury, amalgam, and brine.

(h) "Cell room" means a structure housing one or more mercury electrolytic chlor-alkali cells.

§ 61.52 Abbreviations.

The abbreviations used in this subpart have the following meanings in both capital and lower case:

Hg—mercury.

§ 61.53 Emission standard for mercury.

Emissions to the atmosphere from sources subject to this subpart shall not exceed 2,300 grams of mercury per 24-hour period (5.0 pounds per 24-hour period), as measured in accordance with techniques set forth in the appendix.

§ 61.54 Test methods and procedures—mercury ore processing facility.

All facilities processing mercury ore shall be tested by Method 1 in the appendix. The minimum sampling time shall be 2 hours, and the minimum sampling volume shall be 50 ft³ as measured by the gas meter. For each repetition, mercury emission expressed in pounds per day shall be determined in accordance with Method 1.

§ 61.55 Periodic emission testing—mercury ore processing facility.

(a) All existing sources shall be tested within 3 months of the effective date of these regulations and at least once every 3 months thereafter.

(b) All sources constructed after the effective date of these regulations shall be tested immediately upon start-up of operation and at least once every 3 months thereafter.

(c) Samples shall be taken over such a period or periods as are necessary to accurately determine the maximum emissions which would occur in a 24-hour period. In the case of cyclic operations, sufficient tests shall be made so as to allow accurate determination or calculation of the emissions which will occur over the duration of the cycle.

(d) All samples shall be analyzed, and mercury emissions shall be calculated within 5 working days after collection of samples. A total emission exceeding the standard shall be reported to the Administrator immediately following determination of such emission.

§ 61.56 Record keeping—mercury ore processing facility.

Written records of information obtained in § 61.55 as well as other operating data which will allow determination or calculation of mercury emissions for a 24-hour period shall be established and made available for inspection by the Administrator. Such records shall be maintained for a period of at least two years from the date of the record.

§ 61.57 Waiver of emission test requirements—mercury ore processing facility.

(a) After performance of initial emission tests, the requirements of § 61.55 may be waived upon written application to the Administrator if in his judgment the installed control system and the operating techniques are deemed adequate to ensure the standard will be met. This waiver in no way prohibits the Administrator from requiring one or more emission tests.

(b) Detailed information on necessary requirements for waiver qualifications may be obtained by submitting a written request to the Environmental Protection Agency, Office of Air Programs, Division of Compliance, Research Triangle Park, N.C. 27711.

§ 61.58 Test methods and procedures—mercury cell chlor-alkali plant.

(a) All facilities operating mercury cell chlor-alkali plants shall test their process gases, which are hydrogen from the denuders and vent gases from the end boxes of the chlorine cells, for mercury particulates and vapors using Method 1 in the appendix. The minimum sampling time shall be 2 hours, and the minimum sampling volume shall be 50 ft³ as measured by the gas meter. For each repetition, mercury emission expressed in pounds per day shall be determined in accordance with Method 1.

(b) These facilities shall test their mercury emissions in the ventilation effluents from the cell room using Method 2 in the appendix. The average emissions of mercury as vapor from long, narrow ventilation ducts, square or rectangular openings or fans shall be determined as given below using Method 2.

(1) Long, narrow ventilation ducts of the cell room should be sampled at six equally spaced locations. Use the same sample train for all six samples which are taken consecutively. The samples should be extracted at a rate proportional to the gas velocity at each point. The minimum sampling time shall be 1½ hours, and the minimum sampling volume shall be 3.0 ft³ as measured by the gas meter. The sample shall be collected in a manner described in Method 2.

(2) Square or rectangular openings with an area greater than 16 ft² shall be split into eight sections. A sample from the center of each section shall be taken as described in subparagraph (1) of this paragraph. Openings with less than 16 ft² shall be split into four sections and a sample taken from the center of each section.

(3) Velocities of effluents out of ventilators shall be measured with a vane anemometer.

(4) Fans used for ventilation of cell room shall be sampled. Fans with uniform discharges out the fan housing shall be sampled in the center of air flow. Volume shall be determined from the fan curve. Sample at a rate proportional to the average gas flow rate. The minimum sample time shall be 1½ hours, and the minimum sampling volume shall be 3.0 ft³ as measured by the gas meter. Fans with gas discharges out of the periphery of the fan housing shall be sampled in the center of the gas flow in a manner similar to that described above.

(5) Total mercury emitted per 24-hour period from the cell room shall be the sum of emissions from all ventilators.

§ 61.59 Periodic emission testing—mercury cell chlor-alkali plant.

(a) All existing sources shall be tested within 3 months of the effective date of these regulations and at least once every 3 months thereafter.

(b) All sources constructed after the effective date of these regulations shall be tested immediately upon start-up of operation and at least once every 3 months thereafter.

(c) Samples shall be taken over such a period or periods as are necessary to accurately determine the maximum emissions which would occur in a 24-hour period. In the case of cyclic operations, sufficient tests shall be made so as to allow

accurate determination of the emissions which will occur over the duration of the cycle.

(d) All samples shall be analyzed and mercury emissions shall be calculated within 5 working days after collection of samples. A total emission exceeding the standard shall be reported to the Administrator immediately following determination of such emission.

§ 61.60 Record keeping—mercury cell chlor-alkali plant.

Written records of information obtained in § 61.59 as well as other operating data which will allow determination or calculation of mercury emissions for a 24-hour period shall be established and made available for inspection by the Administrator. Such records shall be maintained for a period of at least 2 years from the date of the record.

§ 61.61 Waiver of emission test requirements—mercury cell chlor-alkali facility.

(a) After performance of initial emission tests, the requirements of § 61.59 may be waived upon written application to the Administrator if in his judgment the installed control system and the operating techniques are deemed adequate to ensure the standard will be met. This waiver in no way prohibits the Adminis-

trator from requiring one or more emission tests.

(b) Detailed information on necessary requirements for waiver qualifications may be obtained by submitting a written request to the Environmental Protection Agency, Office of Air Programs, Division of Compliance, Research Triangle Park, N.C. 27711.

METHOD 1—DETERMINATION OF MERCURY IN PARTICULATE AND GASEOUS EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. Particulate and gaseous emissions are isokinetically sampled from the source and collected in acidic iodine monochloride solution. The mercury collected (in the mercuric state) is reduced to elemental mercury in basic solution by hydroxylamine sulfate. Mercury is vaporized from the solution using a zero grade air stream and analyzed using an atomic absorption spectrophotometer in the flameless mode.

1.2 Applicability. This method is applicable for the determination of mercury in particulate and gaseous emissions from stationary sources only when specified by the test procedures for determining compliance with the Clean Air Act.

2. *Apparatus.*

2.1 Sampling train. The design specifications of the particulate sampling train used by EPA (Figure 1-1) are described in APTD-0581. Commercial models of this train are available.

maintain an isokinetic sampling rate and to determine sample volume.

2.1.7 Barometer—To measure atmospheric pressure to ±0.1 inches Hg.

2.2 Measurement of stack conditions (stack pressure, temperature, moisture and velocity).

2.2.1 Pitot tube—Type S (Figure 1-2), or equivalent, with a coefficient within ±5% over the working range.

Figure 1-2. Pitot tube - manometer assembly.

2.2.2 Differential pressure gauge—Inclined manometer, or equivalent, to measure velocity head to within 10% of the minimum value.

2.2.3 Temperature gauge—Thermocouple. or equivalent, attached to the pitot tube to measure stack temperature to within 1.5% of the minimum absolute stack temperature.

2.2.4 Pressure gauge—Mercury-filled U-tube manometer, or equivalent, to measure stack pressure to within 0.1 in. Hg.

2.2.5 Barometer — To measure atmospheric pressure to within 0.1 in. Hg.

2.2.6 Thermometers—Wet and dry bulb.

2.3 Sample Recovery.

2.3.1 Leakless glass sample bottles—(one) 500 ml. and (two) 100 ml. with Teflon * lined tops.

2.3.2 Graduated cylinder—250 ml.

2.3.3 Plastic jar—one, approximately 300 ml.

2.4 Analysis.

2.4.1 Atomic absorption spectrophotometer (A.A.S.)—Perkin Elmer Model 303, or equivalent, with a cylindrical gas cell (approximately 1.5 in. O.D. x 7 in.) with quartz glass windows.

2.4.2 Analysis tube—100 ml., glass, bulb type, "Mae West", with ground glass fittings.

2.4.3 Light source—Mercury vapor lamp

2.4.4 Recorder—(one) to match output of atomic absorption spectrophotometer.

2.4.5 Trip balance—300 g. capacity, to measure to ±0.05 g.

3. *Reagents.*

3.1 Stock Reagent.

3.1.1 Potassium Iodide (KI) 25% W/V (weight/volume)—Dissolve 250 grams of KI in distilled water and dilute to 1 liter.

3.1.2 Hydrochloric acid (HCl)—concentrated.

3.1.3 Potassium iodate—reagent grade.

3.1.4 Distilled water.

3.1.5 Iodine monochloride (ICl)—1.0M—to 800 ml. of 25% potassium iodide solution (reagent 3.1.1), add 800 ml. of concentrated hydrochloric acid. Cool to room temperature. With vigorous stirring, slowly add 135 grams of potassium iodate and continue stirring until all free iodine has dissolved to give a clear orange-red solution. Cool to room temperature and dilute to 1,800 ml.

3.2 Sampling.

3.2.1 Filter—Glass fiber, Mine Safety Appliances 1106 BH*, or equivalent, numbered for identification and preweighed.

Figure 1-1. Particulate-sampling train.

2.1.1 Nozzle—Stainless steel (316) with sharp, tapered leading edge.

2.1.2 Probe—Pyrex* ¹ glass with a heating system capable of maintaining a minimum gas temperature of 250° F at the exit end during sampling to prevent condensation from occurring. Probes for sampling gas streams at temperatures in excess of 600° F and where length limitations are encountered are subject to approval by the Administrator.

2.1.3 Pitot tube—Type S, or equivalent, attached to probe to monitor stack gas velocity.

2.1.4 Filter Holder—Pyrex* glass.

2.1.5 Impingers—Five impingers connected in series with glass ball joint fittings. The first, third, fourth and fifth are of the Greenburg-Smith design, modified by replacing the tip with a ½-inch ID glass tube extending to ½ inch from the bottom of the flask. The second impinger is of the Greenburg-Smith design with the standard tip.
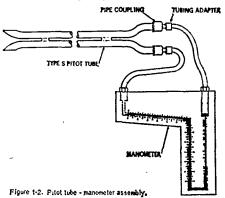
2.1.6 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to

¹ Disclaimer—Mention of trade names or commercial products does not constitute endorsement by the Environmental Protection Agency.

3 2.2 Absorbing solution, iodine monochloride (ICl) 0.1M—Dilute 100 ml. of the 1 0M ICl stock solution (reagent 3.1.5) to 1 liter with distilled water. This reagent is stable for at least 2 months.

3.2.3 Wash acid—1:1 v/v nitric acid—water.

3.2.4 Distilled and deionized water.

3.2.5 Silica gel—Indicating type, 6 to 16 mesh, dried at 175° C (350° F) for 2 hours.

3 2.6 Soda lime—6 to 16 mesh.

3 3 Analysis.

3.3.1 Sodium Hydroxide (NaOH) 10 N.

3.3.2 Reducing agent, 12% W/V hydroxylamine sulfate (NH$_4$OH.1/2 H$_2$SO$_4$), 12% W/V sodium chloride (NaCl)—to 60 ml. of distilled water, add 12 grams of hydroxylamine sulfate and 12 grams of sodium chloride. Dilute to 100 ml. This quantity is sufficient for 20 analyses.

3 3 3 Aeration gas—zero grade air.

3.4 Mercury Standard Solutions.

3 4.1 Stock solution—Add 0.1354 grams of mercuric chloride (HgCl$_2$) to 80 ml. of 0.3N hydrochloric acid (HCl). After the mercuric chloride has dissolved, add 0.3N HCl to adjust the volume of 100 ml. One ml. of this solution is equivalent to 1 mg. of free mercury.

3.4.2 Standard solutions—Prepare calibration solutions of 0.1 μg/ml, 0.4 μg/ml, 0.6 μg/ml, 1.0 μg/ml, and 2.0 μg/ml, by serially diluting the stock solution (3.4.1) with 0.3N HCl. Store in glass-stoppered, glass bottles. These solutions are stable for at least 2 months.

4. *Procedure.*

4.1 Selection of a sampling site and minimum number of traverse points.

4.1.1 Select a sampling site that is at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, contraction, or visible flame. For rectangular cross section, determine an equivalent diameter from the following equation:

$$\text{equivalent diameter} = 2 \left(\frac{(\text{length}) (\text{width})}{\text{length} + \text{width}} \right)$$
eq. 1–1

4.1.2 When the above sampling site criteria can be met, the minimum number of traverse points is four (4) for stacks 1 foot in diameter or less, eight (8) for stacks above 1 foot but 2 feet in diameter or less, and twelve (12) for stacks larger than 2 feet.

4.1 3 Some sampling situations render the above sampling site criteria impractical. When this is the case, choose a convenient sampling location and use Figure 1–3 to determine the minimum number of traverse points.

4.1.4 To use Figure 1–3 first measure the distance from the chosen sampling location to the nearest upstream and downstream disturbances. Determine the corresponding number of traverse points for each distance from Figure 1–3. Select the higher of the two numbers of traverse points, or a greater value, such that for circular stacks the number is a multiple of four, and for rectangular stacks the number follows the criteria of section 4.2.2.

4.1 5 Under no conditions should a sampling point be selected within 1 inch of the stack wall.

Figure 1-3. Minimum number of traverse points.

4.2 Cross-sectional layout and location of traverse points.

4.2.1 For circular stacks locate the traverse points on at least two diameters according to Figure 1-4 and Table 1-1. The traverse axes shall divide the stack cross section into equal parts.

4.2.2 For rectangular stacks divide the cross section into as many equal rectangular areas as traverse points, such that the ratio of the length to the width of the elemental areas is between one and two. Locate the traverse points at the centroid of each equal area according to Figure 1-5.

Figure 1-4. Cross section of circular stack showing location of traverse points on perpendicular diameters.

Figure 1-5. Cross section of rectangular stack divided into 12 equal areas, with traverse points at centroid of each area.

Table 1-1. Location of traverse points in circular stacks
(Percent of stack diameter from inside wall to traverse point)

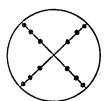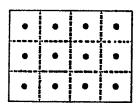| Traverse point number on a diameter	2	4	6	8	10	12	14	16	18	20	22	24
					Number of traverse points on a diameter							
1	14.6	6.7	4.4	3.3	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.7	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.5	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.5	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.3	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.5	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.5	36.6	28.3	23.6	20.4	18.0	16.1
8				96.7	85.4	65.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.1	23.0
10					97.5	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.9	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

tip and pulling a 15 in. Hg. vacuum. A leakage rate not in excess of 0.02 cfm at a vacuum of 15 in. Hg. is acceptable. Release the vacuum on the train, and then turn off the pump. Adjust the heater to provide a gas temperature of about 250°F at the probe outlet. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger at 70°F or less.

4.5 Particulate train operation.

4.5.1 For each run, record the data required on the example sheet shown in Figure 1-6. Take readings at each sampling point, at least every 5 minutes, and when significant changes in stack conditions necessitate additional adjustments in flow rate. To begin sampling, position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Sample for at least 5 minutes at each traverse point; sampling time must be the same for each point. Maintain isokinetic sampling throughout the sampling period. Nomographs are available which aid in the rapid adjustment of the sampling rate without other computations. APTD-0576 details the procedure for using these nomographs. Turn off the pump at the conclusion of each run and record the final readings. Remove the probe and nozzle from the stack and handle in accordance with the sample recovery process described in section 4.6.

PLANT _____
LOCATION _____
OPERATOR _____
DATE _____
RUN NO. _____
SAMPLE BOX NO. _____
METER BOX NO. _____
METER $\Delta H@$ _____
C FACTOR _____

AMBIENT TEMPERATURE _____
BAROMETRIC PRESSURE _____
ASSUMED MOISTURE, % _____
HEATER BOX SETTING _____
PROBE LENGTH, m. _____
NOZZLE DIAMETER, in. _____
PROBE HEATER SETTING _____

SCHEMATIC OF STACK CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (θ, min.)	STATIC PRESSURE (P_s), in. Hg.	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (ΔP_s), in. H$_2$O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H$_2$O	GAS SAMPLE VOLUME (V_m), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER — INLET ($T_{m\ in}$), °F	GAS SAMPLE TEMPERATURE AT DRY GAS METER — OUTLET ($T_{m\ out}$), °F	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
TOTAL										
AVERAGE					Avg.			Avg.		

Figure 1-6. Particulate field data.

4.3 Measurement of stack conditions.

4.3.1 Set up the apparatus as shown in Figure 1-2. Make sure all connections are tight and leak free. Measure the velocity head and temperature at the traverse points specified by sections 4.1 and 4.2.

4.3.2 Measure the static pressure in the stack.

4.3.3 Determine the stack gas moisture using wet and dry bulb thermometers and available psychrometric charts.

4.3.4 Determine the stack gas molecular weight from the measured moisture content and knowledge of the expected gas stream composition.

4.4 Preparation of sampling train.

4.4.1 Prior to assembly, clean all glassware (probe, impingers, and connectors) by rinsing with the acid wash solution (reagent 3.2.3), tap water, 0.1M ICl, tap water, and finally distilled water. Place a filter in the filter assembly. Place 100 ml of 0.1 molar (0.1M) iodine monochloride in each of the first three impingers, and place approximately 200 g. of preweighed silica gel in the fourth impinger. Save 80 ml of the ICl for use as a blank in the sample analysis. Set up the train and the probe as in Figure 1-1.

4.4.2 Leak check the sampling train at the sampling site by plugging up the probe

4.6 Sample recovery.

4.6.1 (All glass storage bottles and graduated cylinder must be precleaned as in section 4.4.1). This operation should be performed in an area free of possible mercury contamination. Disconnect the probe from the impinger train. Place the contents (measured to ±1 ml) of the first three impingers into storage bottle No. 1. Rinse the probe and all glassware between it and the back half of the filter assembly with two 50 ml portions of 0.1M ICl solution. Add these rinses to storage bottle No. 1. For a blank, place 80 ml of the 0.1M ICl in storage bottle No. 3. Place the filter and 100 ml of the 0.1M ICl in storage bottle No. 2 and the silica gel in the plastic jar. Seal and secure all storage containers for shipment. If an additional test is desired, the glassware can be rinsed with distilled water and reassembled. However, if the glassware is to be out of use more than 2 days, the initial acid wash procedure must be followed.

4.7 Analysis.

4.7.1 Apparatus preparation—Clean all glassware according to the procedure of section 4.4.1. Turn on the A.A.S. mercury lamp and allow to warm up for 30 minutes prior

to analysis. Adjust the instrument settings according to the instrument manual, using an absorption wavelength of 253.7 nm.

4.7.2 Analysis preparation—Adjust the air delivery pressure and the needle valve to obtain an air flow of 1.3 l/min. The analysis tube should be bypassed at this time. Purge the equipment for 2 minutes. Prepare a sample of mercury standard solution (3.4.2) according to section 4.7.3. Place the analysis tube in the line, and continue aerating until a maximum peak height is reached on the recorder. Remove the analysis tube, flush the lines, and rinse the analysis tube with distilled water. Repeat with another sample of the same standard solution. This purge and analysis cycle is to be repeated until peak heights are reproducible.

4.7.3 Sample preparation—Just prior to analysis, transfer a sample aliquot of up to 50 ml to the cleaned 100 ml analysis tube. Adjust the volume to 50 ml with 0.1M ICl if required. Add 5 ml of ION NaOH, cap tube with a clean glass stopper and shake vigorously. Add 5 ml of the reducing agent (reagent 3.3.2), cap tube with a clean glass stopper and shake vigorously and immediately place in sample line.

4.7.4 Mercury determination—After the system has been stabilized, prepare samples from each storage bottle according to section 4.7.3. The mercury content is read by comparing the peak heights of the samples to the peak heights of the calibration solutions. If collected samples are out of the linear range, the samples should be diluted. Prepare a blank from storage bottle No. 3 according to section 4.7.3 and analyze to determine the reagent blank mercury level.

5. *Calibration.*

5.1 Sampling Train.

5.1.1 Use standard methods and equipment as detailed in APTD-0576 to calibrate the rate meter, pitot tube, dry gas meter, and probe heater. Recalibrate after each test series.

5.2 Analysis.

5.2.1 Prepare a calibration curve for the atomic absorption spectrophotometer by analyzing the standard mercury solutions. Plot the peak heights read on the recorder versus the weight of mercury in the standard solutions. Standards should be interspersed with the sample analyses since the calibration can change slightly with time.

6. *Calculations.*

6.1 Average dry gas meter temperature, stack temperature, stack pressure and average orifice pressure drop. See data sheet (Figure 1–6).

6.2 Dry gas volume. Correct the sample volume measured by the dry gas meter to stack conditions by using equation 1–2.

$$V_{m_a} = V_m \frac{T_a}{T_m} \frac{P_{bar} + \frac{\Delta H}{13.6}}{P_a} \quad \text{eq. 1-2}$$

where:

V_{m_a}=Volume of gas sample through the dry gas meter (stack conditions), cu. ft.
V_m=Volume of gas sample through the dry gas meter (meter conditions), cu. ft.
T_a=Average absolute temperature of stack gas, °R.
P_{bar}=Barometric pressure at the orifice meter, inches Hg.
ΔH=Average pressure drop across the orifice meter, inches H²O.
13.6=Specific gravity of mercury.
P_a=Average absolute pressure of stack gas, inches Hg.

6.3 Volume of water vapor.

$$V_{w_a} = V_{l_a} \frac{\rho_{H_2O}}{M_{H_2O}} \frac{RT_a}{P_a} \quad \text{eq. 1-3}$$

where:

V_{w_a}=Volume of water vapor in the gas sample (stack conditions), cu. ft.
V_{l_a}=Total volume of liquid collected in impingers and silica gel (see Figure 1–7), ml.
ρ_{H_2O}=Density of water, 1 g./ml.
M_{H_2O}=Molecular weight of water, 18 lb./lb.-mole.
R=Ideal gas constant, 21.83 inches Hg.-cu. ft./lb.
T_a=Absolute stack gas temperature, °R.
P_a=Absolute stack gas pressure, inches Hg.

	VOLUME OF LIQUID WATER COLLECTED	
	IMPINGER VOLUME ml	SILICA GEL WEIGHT g
FINAL		
INITIAL		
LIQUID COLLECTED		
TOTAL VOLUME COLLECTED	g*	ml

CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER. (1 g /ml)

$$\frac{\text{INCREASE, g}}{(1 \text{ g /ml})} = \text{VOLUME WATER, ml}$$

Figure 1–7. Analytical data.

6.4 Total gas volume.

$$V_{Total} = V_{m_a} + V_{w_a} \quad \text{eq. 1-4}$$

where: V_{Total}=Total volume of gas sample (stack conditions), cu. ft.
V_{m_a}=Volume of gas through dry gas meter (stack conditions), cu. ft.
V_{w_a}=Volume of water vapor in gas sample (stack conditions), cu. ft.

6.5 Stack gas velocity.

Use equation 1–5 to calculate the stack gas velocity.

$$V_s = K_p C_p \sqrt{\frac{T_a \Delta p}{P_a M_s}} \quad \text{eq. 1-5}$$

where:
V_s =Stack gas velocity, feet per second (f.p.s.).

$$K_p = 85.48 \quad \frac{ft.}{sec.} \left(\frac{lb.}{lb. \text{ mole-}°R}\right)^{1/2}$$

when these units are used.

C_p =Pitot tube coefficient, dimensionless.
T_a =Average absolute stack gas temperature, °R.
Δ_p =Average velocity head of stack gas, inches H₂O (see Fig. 1–8).
P_a =Average absolute stack gas pressure, inches Hg.
M_s =Molecular weight of stack gas (wet basis), the summation of the products of the molecular weight of each component multiplied by its volumetric proportion in the mixture, lb./lb.-mole.

Figure 1–8 shows a sample recording sheet for velocity traverse data. Use the averages in the last two columns of Figure 1–8 to determine the average stack gas velocity from equation 1–5.

6.6 Mercury collected. Calculate the total weight of mercury collected by using eq. 1–6.

SCHEMATIC OF STACK CROSS SECTION

Traverse point number	Velocity head, in. H₂O	√Δp	Stack Temperature (T_s), °F
AVERAGE:			

Figure 1–8. Velocity traverse data.

$$W_t = V_1 \left(\frac{W_1}{V_1}\right) + V_2 \left(\frac{W_2}{V_2}\right) - V_b(C_b) \quad \text{eq. 1-6}$$

where:
W_t=Total weight of mercury collected, μg.
V_1=Total volume of condensed moisture and ICl in sample bottle No. 1, ml.
w_1=Weight mercury found in sample aliquot from sample bottle No. 1, μg.
v_1=Size of aliquot from sample bottle No. 1, ml.
V_2=Total volume of absorbing solution in ICl in sample bottle No. 2, ml.
w_2=Weight of mercury found in aliquot from sample bottle No. 2, μg.
v_2=Aliquot size from sample bottle No. 2, ml.
V_b=Total volume of ICl used in sampling, (impinger contents + all wash amounts) ml.
C_b=Concentration of mercury in 0.1M ICl solution from sample bottle No. 3, μg./ml.

6.7 Total mercury emission. Calculate the total amount of mercury emitted per day by eq. 1–7.

$$R = 0.00019 \frac{W_t}{V_{total}} V_s A_s \quad \text{eq. 1-7}$$

where:
R=Rate of emission, lbs./day.
W_t=Total weight of mercury collected, μg.
V_{total}=Total volume of gas sample (stack conditions), cu. ft.
V_s=Stack gas velocity, feet per second.
A_s=Stack area, ft.²

6.8 Isokinetic variation (comparison of velocity of gas in sample train to stack velocity).

$$I = \frac{100 \frac{V_{total}}{A_n \theta}}{V_s} \quad \text{eq. 1-8}$$

where:
I=Percent of isokinetic sampling.
V_{total}=Total volume of gas sample (stack conditions), cu. ft.
A_n=Sample probe tip area, ft.².
θ=Sample time, sec.
V_s=Stack gas velocity, feet per second.

6.8.1 Acceptable results. The following range sets the limit on acceptable isokinetic sampling results:

If $90\% \leq I \leq 110\%$, the results are acceptable; otherwise, reject the results and repeat the test.

7. *References.*

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METHOD 2—DETERMINATION OF MERCURY IN GASEOUS EMISSIONS FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. Gaseous samples are collected in impingers containing acidic iodine monochloride solutions. The collected mercury (in the mercuric state) is reduced to elemental mercury in basic solution by hydroxylamine sulfate. Mercury is vaporized from the solution using zero grade air stream and analyzed using an atomic absorption spectrophotometer in the flameless mode.

1.2 Applicability. This method is applicable for the determination of mercury in gaseous emissions from stationary sources only when specified by the test procedures for determining compliance with the Clean Air Act.

2. *Apparatus.*

2.1 Sampling. See Figure 2–1. (Note: All surfaces that come into contact with the iodine monochloride solution must be glass.)

2.1.1 Probe—Pyrex* [a] glass, approximately 5–6 mm. I.D.

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* Trade name.

2.1.2 Impingers—Four midget type.

2.1.3 Drying tube—One, packed with silica gel.

2.1.4 Acid absorbing tube—One, packed with soda lime.

2.1.5 Vacuum pump—Leakless, with capacity to reduce pressure to 3 in. Hg. abs.
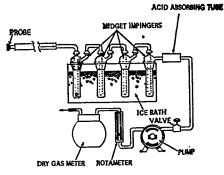

Figure 2-1. Hg sampling train.

2.1.6 Rate meter—Rotameter, or equivalent, to measure 0–10 scfh. (standard cubic feet per hour) flow range.

2.1.7 Dry gas meter—With capacity to measure gas sample volume to $\pm 1\%$.

2.2 Measurement of exit gas conditions (temperature, velocity, and pressure).

2.2.1 Vane anemometer, commercial.

2.2.2 Temperature gauge, to measure exit gas temperature to within 1.5% of minimum absolute exit gas temperature.

2.2.3 Barometer, to measure atmospheric pressure to within 0.1 in. Hg.

2.3 Sample recovery.

2.3.1 Leakless glass sample storage bottles—Two (2), approximately 200 ml. with Teflon lined tops.

2.3.2 Graduated cylinder—100 ml.

2.4 Analysis.

2.4.1 Atomic absorption spectrophotometer (A.A.S.), Perkin-Elmer Model 303, or equivalent, with a cylindrical gas cell (approximately 1.5 in. O. D. x 7 in.) with quartz glass windows.

2.4.2 Analysis tube—100 ml., glass, bulb type, "Mae West," with ground glass fittings.

2.4.3 Light source—Mercury vapor lamp.

2.4.4 Recorder—(One) to match output of atomic absorption spectrophotometer.

3. *Reagents.*

3.1 Stock reagent.

3.1.1 Potassium iodide (KI) 25% W/V (weight/volume)—Dissolve 250 grams of KI in distilled water and dilute to 1 liter.

3.1.2 Hydrochloric acid (HCl)—Concentrated.

3.1.3 Potassium iodate—Reagent grade.

3.1.4 Distilled water.

3.1.5 Iodine monochloride (ICl) 1.0M—To 800 ml of 25% potassium iodide solution (reagent 3.1.1), add 800 ml of concentrated hydrochloric acid. Cool to room temperature. With vigorous stirring, slowly add 135 grams of potassium iodate and continue stirring until all free iodine has dissolved to give a clear orange-red solution. Cool to room temperature and dilute to 1,800 ml.

3.2 Sampling.

3.2.1 Absorbing solution, iodine monochloride (ICl) 0.1M—Dilute 100 ml of the 1.0M ICl stock solution (reagent 3.1.5) to 1 liter with distilled water. This reagent is stable for at least 2 months.

3.2.2 Wash acid—1:1 v/v nitric acid—water.

3.2.3 Distilled and deionized water.

3.3 Analysis.

3.3.1 Sodium hydroxide (NaOH) 10 N.

3.3.2 Reducing agent, 12% W/V hydroxylamine sulfate ($NH_2OH \cdot 1/2 \ H_2SO_4$) 12% W/V sodium chloride (NaCl)—To 60 ml of distilled water, add 12 grams of hydroxyla-

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mine sulfate and 12 grams of sodium chloride. Dilute to 100 ml. This quantity is sufficient for 20 analyses.

3.3.3 Aeration gas—Zero grade air.

3.4 Mercury standard solutions.

3.4.1 Stock solution—Add 0.1354 grams of mercuric chloride ($HgCl_2$) to 80 ml of 0.3N hydrochloric acid (HCl). After the mercuric chloride has dissolved, add 0.3N HCl to adjust the volume to 100 ml. One ml of this solution is equivalent to 1 mg of free mercury.

3.4.2 Standard solutions—Prepare calibration solutions of 0.1 μg/ml, 0.4 μg/ml, 0.6 μg/ml, 1.0 μg/ml, and 2.0 μg/ml by serially diluting the stock solution (3.4.1) with 0.3N HCl. Store in glass-stoppered, glass bottles. These solutions are stable for at least 2 months.

4. *Procedures.*

4.1 Selection of sampling sites.

4.1.1 Long, narrow ventilation ducts of the cell room shall be sampled at six equally spaced locations.

4.1.2 Square or rectangular openings with an area greater than 16 ft² shall be split into eight equal sections. A sample from the center of each section shall be taken as described in section 4.1.1. Openings with less than 16 ft² shall be split into four sections and a sample taken from the center of each section.

4.1.3 Fans with uniform discharges out the fan housing shall be sampled in the center of air flow. Fans with gas discharges out of the periphery of the fan housing shall be sampled in the center of the gas flow.

4.2 Measurement of exit gas conditions.

4.2.1 Measure the exit gas temperature at each sample site. Determine the average temperature.

4.2.2 Measure the barometric pressure at the time of the test.

4.2.3 Velocities of effluents out of ventilators shall be measured with a vane anemometer.

4.2.4 Fan volumes shall be determined from the fan curve.

4.3 Preparation of sampling train.

4.3.1 Prior to assembly, clean all glassware (probe, impingers and connectors) by rinsing with the acid wash solution (reagent 3.2.2), tap water, and finally distilled water. Place 15 ml of 0.1M iodine monochloride in each of the first three midget impingers. The fourth impinger is filled with silica gel. Assemble the sampling train as shown in Figure 2–1.

4.3.2 Place a plug in the probe inlet and leak check the sampling train by applying a vacuum of 10 in. Hg. to the system. If the leakage, as observed on the dry gas meter, exceeds 1% of the desired sampling rate, locate and correct the leaks. Release the vacuum on the train by carefully removing the plug from the probe inlet, then turn off the pump. Place crushed ice around the impingers.

4.4 Sample collection.

4.4.1 Use the same sample train for all samples which are taken consecutively. The samples should be extracted at a rate proportional to the gas velocity at each point. The minimum sampling time and sample volume shall be, respectively, 1½ hours and 3.0 ft³ as measured by the gas meter.

4.4.2 Position the probe tip at the desired sampling point; record the initial reading on the dry gas meter, and additional data required. Start the pump. Establish the initial sampling rate at 2 scfh. Maintain constant flow rate and maintain the ice level in the impinger bath throughout the run. At the end of the run, turn off the pump and record the final reading on the dry gas meter. Place a plug in the probe inlet, and remove sampling train to sample recovery area.

4.5 Sample recovery. (All glass storage bottles must be precleaned as in section 4.3.1).

4 5.1 This operation should be performed in an area free of possible mercury contamination. Disconnect the probe from the impinger train. Place the contents (measured to ±1ml) of the first three impingers into storage bottle No. 1. Rinse the probe and all glassware up to and including the third impinger with 50 ml of 0.1M ICl. Place this rinse portion in storage bottle No. 1. For a blank, place 80 ml of the 0.1M ICl in sample jar No. 2. Seal and secure both storage bottles for shipment. If an additional test is desired, the glassware can be rinsed with distilled water and reassembled. However, if the glassware is to be out of use more than 2 days, the initial acid wash procedure must be followed.

4 6 Analysis.

4.6.1 Apparatus preparation—Clean all glassware according to the procedure of section 4 3.1. Turn on the A.A.S. mercury lamp and allow to warm up for 30 minutes prior to analysis. Adjust the instrument settings according to the instrument manual, using an absorption wavelength of 253.7 nm.

4.6.2 Analysis preparation—Adjust the air delivery pressure and the needle valve to obtain an air flow of 1.3 l/min. The analysis tube should be bypassed at this time. Purge the equipment for 2 minutes. Prepare a sample of a mercury standard solution (3.4.2) according to section 3.4.2. Place the analysis tube in the line, and continue aerating until a maximum peak height is reached on the recorder. Remove the analysis tube, flush the lines and rinse the analysis tube with distilled water. Repeat with another sample of the same standard solution. This purge and analyses cycle is to be repeated until peak heights are reproducible.

4 6.3 Sample preparation—Just prior to analysis, transfer a sample aliquot of up to 50 ml to the cleaned 100 ml analysis tube. Adjust the volume to 50 ml with 0.1M ICl if required. Add 5 ml of 10N NaOH, cap tube with a clean glass stopper and shake vigorously. Add 5 ml of the reducing agent (reagent 3.3.2), cap tube with a clean glass stopper and shake vigorously and immediately place in sample line.

4 6.4 Mercury determination—After the system has been stabilized, prepare samples from each storage bottle according to section 4 6 3. The mercury content is read by comparing the sample peak heights to the peak heights for the calibration solutions. Prepare a blank from storage bottle No. 2 ac-

cording to section 4.6.3 and analyze to determine the reagent blank mercury level.

5. *Calibration.*

5.1 Sampling train.

5.1.1 Use standard methods and equipment as detailed in APTD–0576 to calibrate the rate meter and the dry gas meter.

5.2 Analysis train.

5.2.1 Prepare a calibration curve for the atomic absorption spectrophotometer by analyzing the standard mercury solutions. Plot the peak heights read on the recorder versus the weight of mercury in the standard solutions. Standards should be interspersed with the sample analyses since the calibration can change slightly with time.

6. *Calculations.*

6.1 Gas sample volume at standard conditions. Correct the sample volume measured by the dry gas meter to exit gas conditions by using equation 2–1.

$$V_{m_s} = V_m \frac{T_s}{T_m} \qquad \text{eq. 2-1}$$

where:

V_{m_s} = Total volume of gas sampled at exit gas conditions, ft³.
V_m = Volume of gas sampled through the dry gas meter at meter conditions, ft³.
T_m = Average absolute dry gas meter temperature, °R.
T_s = Average absolute exit gas temperature, °R.

6.2 Volume of water vapor.

$$V_{w_s} = V_{l_o} \frac{\rho_{H_2O}}{M_{H_2O}} R \qquad R = \frac{T_s}{P_{bar}} \qquad \text{eq. 2-2}$$

where:

V_{w_s} = Volume of water vapor in gas sample (exit gas conditions), cu. ft.
V_{l_o} = Total volume of liquid collected in impingers and silica gel (see Figure 2-2), ml.
ρ_{H_2O} = Density of water, 1 g./ml.
M_{H_2O} = Molecular weight of water, 18 lb./lb. mol.
R = Ideal gas constant, 21.83 inches Hg. cu. ft./lb. mole·°R.
T_s = Average absolute exit gas temperature, °R.
P_{bar} = Barometric pressure, inches Hg.

6.3 Total gas volume.

$$V_{total} = V_{m_s} + V_{w_s}$$

where:

V_{total} = Total volume of gas sample (exit gas conditions), cu. ft.
V_{m_s} = Volume of gas through gas meter (exit gas conditions), cu. ft.
V_{w_s} = Volume of water vapor in gas sample (exit gas conditions), cu. ft.

6.4 Mercury collected. Calculate the total weight of mercury collected by using equation 2-3.

$$W_t = V_1 \frac{W_1}{v_1} - V_b(C_b) \qquad \text{eq. 2-3}$$

where:

W_t = Total weight of mercury collected, μg.
V_1 = Total volume of absorbing solution and ICl wash in sample bottle No. 1, ml.
W_1 = Weight of mercury found in aliquot from sample bottle No. 1, μg.
v_1 = Aliquot size from sample bottle No. 1, ml.
V_b = Total volume of ICl used in sampling (impinger contents+all wash amounts) ml.
C_b = Concentration of mercury in 0.1M ICl solution from sample bottle No. 2, μg./ml.

6.5 Total mercury emission. Calculate the total amount of mercury emitted per day by equation 2-4.

$$R = 0.00019 \frac{W_t}{V_{total}} V_s A_s \qquad \text{eq. 2-4}$$

where:

R = Rate of emission, lb./day.
W_t = Total weight of mercury collected, μg.
V_{total} = Total volume of gas sample (exit gas conditions), cu. ft.
V_s = Gas velocity at exit, feet per second.
A_s = Cross-sectional area through which emission occurs, ft².

7. *References.*

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METHOD 3—DETERMINATION OF BERYLLIUM FROM STATIONARY SOURCES

1. *Principle and applicability.*

1.1 Principle. Beryllium laden gases are withdrawn isokinetically from the source, and the collected sample is digested in an acid solution and analyzed by the atomic absorption procedure.

1.2 Applicability. This method is applicable for the determination of beryllium emissions only when specified by the test procedures for determining compliance with the Clean Air Act.

2. *Apparatus.*

2.1 Sampling train. The design specifications of the particulate sampling train used by EPA (Figure 3–1) are described in APTD–0581. Commercial models of this train are available.
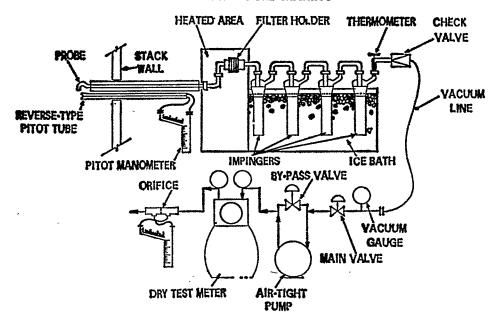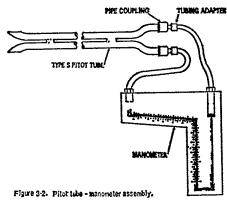
Figure 3-1. Particulate-sampling train.

2.1.1 Nozzle—Stainless steel (316) with sharp, tapered leading edge.

2.1.2 Probe—Pyrex* ³ glass with a heating system capable of maintaining a minimum gas temperature of 250°F at the exit end during sampling to prevent condensation from occurring. When length limitations (greater than about 8 ft) are encountered at temperatures less than 600°F, Incology 825*,³ or equivalent, may be used. Probes for sampling gas streams at temperatures in excess of 600°F are subject to approval by the Administrator.

2.1.3 Pitot tube—Type S, or equivalent, attached to probe to monitor stack gas velocity.

2.1.4 Filter holder—Pyrex* glass with heating system capable of maintaining a minimum temperature of 225°F.

2.1.5 Impingers—Four impingers connected in series with glass ball joint fittings. The first, third, and fourth impingers are of the Greenburg-Smith design, modified by replacing the tip with a ½-inch ID glass tube extending to ½ inch from the bottom of the flask. The second impinger is of the Greenburg-Smith design with the standard tip.

2.1.6 Metering system—Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 5°F, dry gas meter with 2% accuracy, and related equipment, or equivalent, as required to maintain an isokinetic sampling rate and to determine sample volume.

2.1.7 Barometer—To measure atmospheric pressure to ±0.1 inch Hg.

2.2 Measurement of stack conditions (stack pressure, temperature, moisture and velocity).

2.2.1 Pitot tube—Type S (Figure 3-2), or equivalent, with a coefficient within ±5% over the working range.

³ Trade name.

Figure 3-2. Pitot tube - manometer assembly.

2.2.2 Differential pressure gauge—Inclined manometer, or equivalent, to measure velocity head to within 10% of the minimum value.

2.2.3 Temperature gauge—Thermocouple or equivalent, attached to the pitot tube to measure stack temperature to within 1.5% of the minimum absolute stack temperature.

2.2.4 Pressure gauge—Mercury-filled U-tube manometer, or equivalent, to measure stack pressure to within 0.1 in. Hg.

2.2.5 Barometer—To measure atmospheric pressure to within 0.1 in. Hg.

2.2.6 Thermometers—Wet and dry bulb.

2.3 Sample recovery.

2.3.1 Probe brush—At least as long as probe.

2.3.2 Glass wash bottles—Two.

2.3.3 Glass sample storage containers.

2.3.4 Graduated cylinder—250 ml.

2.4 Analysis.

2.4.1 Atomic absorption spectrophotometer (A.A.S.), Perkin Elmer Model 303, or equivalent, with N₂O/acetylene burner.

2.4.2 Beakers—150 ml, 400 ml.

2.4.3 Pipette—Volumetric, 10 ml.

2.4.4 Volumetric flasks—1 liter.

2.4.5 Hot plate.

2.4.6 Perchloric acid fume hood.

3. *Reagents.*

3.1 Sampling.

3.1.1 Filters—Millipore AA*, or equivalent, numbered for identification and preweighted. It is suggested that a Whatman 41 filter be placed immediately against the back side of the Millipore filter as a guard against breaking the Millipore filter. In the analysis of the filter, the Whatman 41 filter should be included with the Millipore filter.

3.1.2 Silica gel—Indicating type, 6 to 16 mesh, dried at 175°C (350°F) for 2 hours.

3.1.3 Water—Deionized doubly distilled.

3.1.4 Crushed ice.

3.2 Sample recovery.

3.2.1 Water—Deionized, double distilled.

3.2.2 Acetone—Reagents grade.

3.3 Analysis.

3.3.1 Water—Deionized double distilled.

3.3.2 Hydrochloric acid (HCl)—Concentrated.

3.3.3 Perchloric acid—Concentrated, 70%.

3.3.4 Nitric acid (HNO₃)—Concentrated.

3.3.5 Sulfuric acid (H₂SO₄)—Concentrated.

3.3.6 Standard 1.0 ppm (by weight) beryllium solution. Dissolve 100.0 mg of beryllium in 700 ml of 50% (by weight) H₂SO₄ and dilute to a volume of 1,000 ml with double distilled water. Dilute a 10 ml aliquot to 1,000 ml with double distilled water, giving a concentration of 1.0 ppm.

3.3.7 Nitrous oxide (N₂O)—98% minimum purity.

3.3.8 Acetylene.

3.3.9 Compressed air.

4. *Procedure.*

4.1 Selection of a sampling site and minimum number of traverse points.

4.1.1 Select a sampling site that is at least eight stack or duct diameters downstream and two diameters upstream from

any flow disturbance such as a bend, expansion, contraction, or visible flame. For rectangular cross section, determine an equivalent diameter from the following equation:

$$\text{equivalent diameter} = 2\left(\frac{(\text{length})}{\text{length}} + \frac{(\text{width})}{\text{width}}\right)$$
eq. 3–1

4.1.2 When the above sampling site criteria can be met, the minimum number of points.

traverse points is four (4) for stacks 1 foot in diameter or less, eight (8) for stacks above 1 foot but 2 feet in diameter or less and twelve (12) for stacks larger than 2 feet.

4.1.3 Some sampling situations render the above sampling site criteria impractical. When this is the case, choose a convenient sampling location and use Figure 3–3 to determine the minimum number of traverse points.
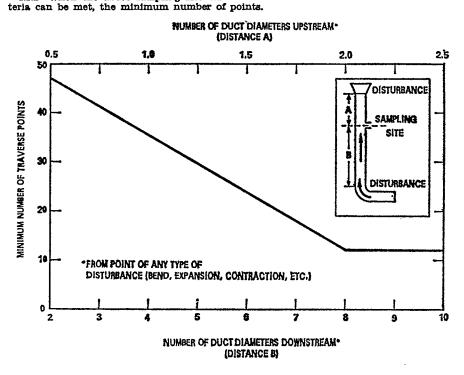
NUMBER OF DUCT DIAMETERS UPSTREAM*
(DISTANCE A)

*FROM POINT OF ANY TYPE OF DISTURBANCE (BEND, EXPANSION, CONTRACTION, ETC.)

NUMBER OF DUCT DIAMETERS DOWNSTREAM*
(DISTANCE B)

Figure 3-3. Minimum number of traverse points.

4.1.4 To use Figure 3-3, first measure the distance from the chosen sampling location to the nearest upstream and downstream disturbances. Determine the corresponding number of traverse points for each distance from Figure 3-3. Select the higher of the two numbers of traverse points, or a greater value, such that for circular stacks the number is a multiple of four, and for rectangular stacks the number follows the criteria of section 4.2.2.

4.1.5 Under no conditions should a sampling point be selected within one inch of the stack wall.

4.2 Cross-sectional layout and location of traverse points.

4.2.1 For circular stacks locate the traverse points on at least two diameters according to Figure 3-4 and Table 3-1. The traverse axes shall divide the stack cross section into equal parts.

4.2.2 For rectangular stacks divide the cross section into as many equal rectangular areas as traverse points, such that the ratio of the length to the width of the elemental areas is between one and two. Locate the

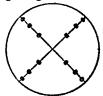traverse points at the centroid of each equal area according to Figure 3-5.

Figure 3-4. Cross section of circular stack showing location of traverse points on perpendicular diameters.
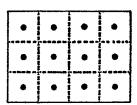

Figure 3-5. Cross section of rectangular stack divided into 12 equal areas, with traverse points at centroid of each area.

Table 3-1. Location of traverse points in circular stacks
(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.3	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.7	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.5	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.5	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.3	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.5	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.5	36.6	28.3	23.6	20.4	18.0	16.1
8				96.7	85.4	65.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.1	23.0
10					97.5	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.9	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

4.3 Measurement of stack conditions.

4.3.1 Set up the apparatus as shown in Figure 3-2. Make sure all connections are tight and leak free. Measure the velocity head and temperature at the traverse points specified by sections 4.1 and 4.2.

4.3.2 Measure the static pressure in the stack.

4.3.3 Determine the stack gas moisture using wet and dry bulb thermometers and available psychrometric charts.

4.3.4 Determine the stack gas molecular weight from the measured moisture content and knowledge of the expected gas stream composition.

4.4 Preparation of collection train.

4.4.1 Weigh to the nearest gram approximately 200 g. of silica gel. Label a filter of proper diameter, desiccate*⁴ for at least 24 hours and weigh to the nearest 0.5 mg in a room where the relative humidity is less than 50%. Place 100 ml of distilled water in each of the first two impingers, leave the third impinger empty, and place approximately 200 g. of preweighed silica gel in the fourth impinger. Save a portion of the distilled water for use as a blank in the sample analysis. Set up the train without the probe as in Figure 3-1.

4.4.2 Leak check the sampling train at the sampling site by plugging up the probe

tip and pulling a 15 in. Hg. vacuum. A leakage rate not in excess of 0.02 cfm at a vacuum of 15 in. Hg. is acceptable. Adjust the heater to provide a gas temperature of about 250°F at the probe outlet. Turn on the filter heating system. Place crushed ice around the impingers. Add more ice during the run to keep the temperature of the gases leaving the last impinger as low as possible and preferably at 70°F, or less.

4.5 Particulate train operation.

4.5.1 For each run, record the data required on the example sheet shown in Figure 3-6. Take readings at each sampling point at least every 5 minutes and when significant changes in stack conditions necessitate additional adjustments in flow rate. To begin sampling, position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Sample for at least 5 minutes at each traverse point; sampling time must be the same for each point. Maintain isokinetic sampling throughout the sampling period. Nomographs are available which aid in the rapid adjustment of the sampling rate without other computations. APTD-0576 details the procedure for using these nomographs. Turn off the pump at the conclusion of each run and record the final readings. Remove the probe and nozzle from the stack and handle in accordance with the sample recovery process described in section 4.6.

Dry using Drierite at 70°F±10°F.

PLANT_____						AMBIENT TEMPERATURE_____
LOCATION_____						BAROMETRIC PRESSURE_____
OPERATOR_____						ASSUMED MOISTURE, %_____
DATE_____						HEATER BOX SETTING_____
RUN NO._____						PROBE LENGTH, m._____
SAMPLE BOX NO._____						NOZZLE DIAMETER, in._____
METER BOX NO._____						PROBE HEATER SETTING_____
METER ΔH_g _____						
C FACTOR_____						

SCHEMATIC OF STACK CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (θ, min.)	STATIC PRESSURE (P_g), in Hg	STACK TEMPERATURE (T_s), °F	VELOCITY HEAD (Δ P_g),	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH), in. H₂O	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
							INLET (Tm in), °F	OUTLET (Tm out), °F		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 3-6. Particulate field data.

4.6 Sample recovery.

4.6.1 Exercise care in moving the collection train from the test site to the sample recovery area to minimize the loss of collected sample or the gain of extraneous particulate matter. Set aside portions of the water and acetone used in the sample recovery as blanks for analysis. Place the samples in containers as follows:

Container No. 1. Remove the filter and any loose particulate matter from the filter holder and place in this container and seal.

Container No. 2. Measure the volume of water from the first three impingers (to ±1 ml) and place the water in this container. Place water and acetone rinsings of all sample-exposed surfaces between the filter and the fourth impinger in this container. Place acetone washings from all sample-exposed surfaces prior to the filter in this container also.

Container No. 3. Transfer the silica gel from the fourth impinger to the original container and seal. Use a rubber policeman as an aid in removing silica gel from the impinger.

4.7 Analysis (All glassware used in the analyses must be acid cleaned by soaking in 50%, by volume, HNO₃ for 2 hours).

4.7.1 Handle each sample container as follows:

Container No. 1. Transfer the filter and any loose particulate matter from the sample container to a 150 ml beaker. Add 35 ml concentrated nitric acid. Heat on a hotplate for 5 to 10 min. to destroy any organic matter. Cool to room temperature and add 5 ml concentrated sulfuric acid and 5 ml concentrated perchloric acid. Then proceed with step 4.7.2.

Container No. 2. Place a portion of the water and acetone sample into a 150 ml beaker and put on a hotplate. Add portions of the remainder as evaporation proceeds and evaporate to dryness. Cool the residue and add 35 ml concentrated nitric acid, 5 ml concentrated sulfuric acid, and 5 ml concentrated perchloric acid. Then proceed with step 4.7.2.

Container No. 3. Weigh the spent silica gel and report to the nearest gram.

4.7.2 Replace on a hot plate and evaporate to dryness in a perchloric acid hood. Cool and dissolve the residue in 10 ml. of 25%, by volume, HCl. Samples are now ready for the atomic adsorption unit. The beryllium concentration of the sample must be within the calibration range of the A.A.S. If necessary, further dilution of sample with 25%, by volume, HCl must be performed to bring the sample within the calibration range.

4.7.3 Standardize the A.A.S. per section 5 of this method and analyze the samples at 234.8 nm using a nitrous oxide/acetylene flame.

5. Calibration and standards.

5.1 Sampling train.

5.1.1 Use standard methods and equipment as detailed in APTD-0576 to calibrate the rate meter, pitot tube, dry gas meter and probe heater. Recalibrate after each test series.

5.2 Analysis.

5.2.1 Standardization is made with procedure as suggested by the A.A.S. manufacturer with standard beryllium solution. The linearity of working range should be established with a series of standard solutions. If collected samples are out of the linear range, the samples should be diluted.

6. Calculations.

6.1 Average dry gas meter temperature, stack temperature, stack pressure and average orifice pressure drop. See data sheet (Figure 3-6).

6.2 Dry gas volume. Correct the sample volume measured by the dry gas meter to stack conditions by using equation 3-2.

$$V_{m_s} = V_m \frac{T_s}{T_m} \frac{P_{bar} + \frac{\Delta H}{13.6}}{P_s}$$

eq. 3-2

where:
V_{m_s}=Volume of gas sample through the dry gas meter (stack conditions), cu. ft.
V_m=Volume of gas sample through the dry gas meter (meter conditions), cu. ft.
T_s=Average absolute temperature of stack gas, °R.

T_m=Average absolute dry gas meter temperature, °R.
P_{bar}=Barometric pressure at the orifice meter, inches Hg.
ΔH=Average pressure drop across the orifice meter, inches H₂O.
13.6=Specific gravity of mercury.
P_s=Average absolute pressure of stack gas, inches Hg.

6.3 Volume of water vapor.

$$V_{w_s} = V_{l_c} \frac{\rho_{H_2O}}{M_{H_2O}} \frac{RT_s}{P_s}$$

where:
V_{w_s}=Volume of water vapor in the gas sample (stack conditions), cu. ft.
V_{l_c}=Total volume of liquid collected in impingers and silica gel (see Figure 3-7), ml.
ρ_{H_2O}=Density of water, 1 g./ml.
M_{H_2O}=Molecular weight of water, 18 lb./lb.-mole.
R=Ideal gas constant, 21.83 inches Hg-cu. ft./lb.-mole-°R.
T_s=Absolute stack gas temperature, °R.
P_s=Absolute stack gas pressure, inches Hg.

	VOLUME OF LIQUID WATER COLLECTED	
	IMPINGER VOLUME, ml	SILICA GEL WEIGHT g
FINAL		
INITIAL		
LIQUID COLLECTED		
TOTAL VOLUME COLLECTED	g*	ml

CONVERT WEIGHT OF WATER TO VOLUME BY DIVIDING TOTAL WEIGHT INCREASE BY DENSITY OF WATER. (1 g ml)

$$\frac{INCREASE, g}{(1 g ml)} = VOLUME WATER, ml$$

Figure 3-7. Analytical data.

6.4 Total gas volume.

$$V_{total} = V_{m_s} + V_{w_s}$$

eq. 3-4

where:
V_{total}=Total volume of gas sample (stack conditions), cu. ft.
V_{m_s}=Volume of gas through dry gas meter (stack conditions), cu. ft.
V_{w_s}=Volume of water vapor in gas sample (stack conditions), cu. ft.

6.5 Stack gas velocity.

Use equation 3-5 to calculate the stack gas velocity.

$$V_s = K_p C_p \sqrt{\frac{T_s \Delta_p}{P_s M_s}}$$

eq. 3-5

where:
V_s=Stack gas velocity, feet per second (f.p.s.).
$K_p = 85.48 \frac{ft.}{sec.} \left(\frac{lb.}{lb. mole-°R}\right)^{1/2}$ when these units are used.
C_p=Pitot tube coefficient, dimensionless.
T_s=Average absolute stack gas temperature, °R.
Δ_p=Average velocity head of stack gas, inches H₂O (see Figure 3-8).
P_s=Average absolute stack gas pressure, inches Hg.
M_s=Molecular weight of stack gas (wet basis), the summation of the products of the molecular weight of each component multiplied by its volumetric proportion in the mixture, lb./lb.-mole.

PLANT_____
DATE_____
RUN NO._____
STACK DIAMETER, in._____
BAROMETRIC PRESSURE, in. Hg_____
STATIC PRESSURE IN STACK P_g, in. Hg_____
OPERATORS_____

SCHEMATIC OF STACK
CROSS SECTION

Traverse point number	Velocity head, in. H₂O	√Δp	Stack Temperature (t_s), °F
AVERAGE:			

Figure 3-8. Velocity traverse data.

Figure 3-8 shows a sample recording sheet for velocity traverse data. Use the averages in the last two columns of Figure 3-8 to determine the average stack gas velocity from equation 3-5.

6.6 Beryllium collected. Calculate the total weight of beryllium collected by using equation 3-6.

$$W_t = V_1 \frac{W_1}{v_1} + V_2 \frac{W_2}{v_2} - V_w C_w - V_a C_a \qquad \text{eq. 3-6}$$

where:
W_t=Total weight of beryllium collected, μg.
V_1=Total volume of HCl in sample bottle No. 1, ml.
W_1=Weight beryllium found in sample aliquot from sample bottle No. 1, μg.
v_1=Size of aliquot from sample bottle No. 1, ml.
V_2=Total volume of HCl in sample bottle No. 2, ml.
W_2=Weight beryllium found in sample aliquot from sample bottle No. 2, μg.
v_2=Size of aliquot from sample bottle No. 2, ml.
V_w=Total volume of water used in sampling (impinger contents plus all wash amounts), ml.
C_w=Concentration of beryllium in water, μg./ml.
V_a=Total volume of acetone used in sampling (all wash amounts), ml.
C_a=Concentration of beryllium in acetone, μg./ml.

6.7 Total beryllium emission. Calculate the total amount of beryllium emitted per day by equation 3-7.

$$R = 0.00006 \frac{W_t}{V_{total}} V_s A_s T \qquad \text{eq. 3-7}$$

where:
R=Rate of emission, gms./day.
W_t=Total weight of beryllium collected, μg.
V_{total}=Total volume of gas samlpe (stack conditions), cu. ft.
V_s=Stack velocity, feet per second.
A_s=Stack area, ft.²
T=Total time of stack operation, minutes/day.

6.8 Isokinetic variation (comparison of velocity of gas in sample train to stack velocity).

$$I = \frac{100 \dfrac{V_{total}}{A_n \theta}}{V_s} \qquad \text{eq. 3-8}$$

where:
I=Percent of isokinetic sampling.
V_{total}=Total volume of gas sample (stack conditions), cu. ft.
A_n=Sample probe tip area, ft.²
θ=Sampling time, sec.
V_s=Stack gas velocity, feet per second.

6.8.1 Acceptable results. The following range sets the limit on acceptable isokinetic sampling results:

If $90\% \leq I \leq 100\%$, the results are acceptable; otherwise, reject the results and repeat the test.

7. References.

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FEDERAL RESERVE SYSTEM

[12 CFR Part 222]

BANK HOLDING COMPANIES

Delay of Hearing Regarding Armored Car and Courier Services

On November 10, 1971, the Board of Governors announced that it would conduct a hearing December 10, 1971, on the issues involved in bank holding companies engaging in armored car and courier services (36 F.R. 21897, Nov. 17, 1971).

In response to a "Motion for Extension of Time and Institution of Formal Rulemaking Proceedings" filed by counsel for the National Courier Association and the National Armored Car Association, the Board has postponed the hearing date to January 19, 1972. All views expressed in written comments on the proposal that are received by February 11, 1972, will be given consideration.

The Board has denied the request by the Associations that the hearing be conducted under sections 556 and 557 of title 5, United States Code. The Board explored the question of the nature of hearings under section 4(c)(8) of the Bank Holding Company Act in January 1971 before its original proposal to implement that section. It concluded that the law does not require a formal hearing in connection with the issuance of regulations under that section. The Board reaffirms that conclusion.

By order of the Board of Governors, November 30, 1971.

[SEAL] TYNAN SMITH,
Secretary of the Board.

[FR Doc.71–17804 Filed 12–6–71;8:47 am]

SECURITIES AND EXCHANGE COMMISSION

[17 CFR Part 239]

[Release No. 33–5212]

REGISTRATION OF CERTAIN SECURITIES

Use of Optional Form S–16

Notice is hereby given that the Securities and Exchange Commission has